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## English as an international language of science and its effect on Nordic terminology: the view of scientists

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1 Anna Kristina Hultgren

## 2 6 English as an international language 3 of science and its effect on Nordic 4 terminology: the view of scientists<sup>1</sup> 5 6 7

8 **Abstract:** This chapter is concerned with attitudes to English as an international  
9 language of science among Nordic scientists. It reports on a questionnaire com-  
10 pleted by 200+ physicists, chemists and computer scientists at universities in five  
11 Nordic countries: Iceland, Norway, Denmark, Sweden and Finland. The purpose is  
12 two-fold: First, it investigates if claims made primarily by representatives of the  
13 national language councils about a lack of local language terminology are corro-  
14 borated by scientists themselves. It is found that Nordic scientists do believe that  
15 local language terminology is missing, but the extent to which they consider this  
16 problematic or a cause for concern varies. Second, the study compares attitudes  
17 across the five national contexts. Previous studies have documented that attitudes  
18 towards English held by the general public in the Nordic community can be  
19 ranked on a continuum with Icelanders being the most purist and Danes the least  
20 (Kristiansen and Sandøy 2010; Kristiansen 2010). This continuum is only partly  
21 replicated among Nordic scientists. Some possible reasons are discussed as well  
22 as some implications for language policy.  
23

24 **Keywords:** English as a language of science, attitudes, Nordic countries,  
25 scientists, questionnaire, domain loss  
26  
27

## 28 1 Introduction 29

30 This chapter reports on the attitudes of scientists in five Nordic states toward  
31 an alleged lack of scientific terminology in the national languages and on their  
32 reactions to these alleged lexical gaps. The states included in the survey are,  
33 from west to east: Iceland, Norway, Denmark, Sweden and Finland.<sup>2</sup> The study  
34 is a response to an ever increasing use of English in Nordic universities,<sup>3</sup> and to  
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36 <sup>1</sup> The author would like to thank the two reviewers whose comments and suggestions signifi-  
37 cantly improved this chapter.

38 <sup>2</sup> Not included are a number of associated territories that are part of the Nordic region (e.g.  
39 Svalbard, the Faroes, Greenland and Åland).

40 <sup>3</sup> For documentation on the Englishization of Nordic universities, see, e.g. contributors to  
Gregersen 2014.

the debates this has generated concerning the future of the Nordic languages as academic languages (Danish Ministry of Culture 2008; Norwegian Department of Cultural and Ecclesiastical Affairs 2008; Swedish Department of Culture 2002; Finnish Language Council 2009; Finnish Swedish Language Council 2003; Icelandic Parliament 2011). The protagonists in these debates have been multi-faceted and varied, ranging across trained grammarians, phoneticians, bilingualism researchers, directors of the national language councils,<sup>4</sup> members of the cultural elite, politicians and members of the public. While concerns about the increasing use of English in Nordic universities have centred on such issues as social fragmentation, threats to democracy, disadvantages faced by students and academics who do not have English as their first language (see, e.g., contributors to Harder 2009), the focus here is on language itself, more specifically on the extent to which it is endowed with the national-language lexical resources needed for scientific purposes and not explicitly on any potential communicative disadvantages faced by language users in this context (for some recent studies on communicative disadvantages in other European academic contexts, see, e.g., Gnutzmann & Rabe 2014; Ferguson, Pérez-Llantada and Plo 2011; Lillis and Curry 2010).

There is a lack of empirical studies on national language terminology in a Nordic context, but interviews with students and faculty at the Norwegian University of Science and Technology suggest that there are sometimes no Norwegian equivalents of English scientific terms, such as, e.g., “*impact category*” and “*stressor*” (Ljosland 2008; Ljosland 2014). This chapter sets out to survey how widespread such an alleged lack of national language terminology is across the Nordic speech communities. While questionnaires have often been employed by researchers interested in understanding the effects of Englishization at Nordic universities, their focus has rarely been explicitly on national language terminology but on other issues such as the attitudes and practices of staff and students who regularly teach, learn, write and read in English (Hellekjær 2010; Kuteeva & Airey 2014; Bolton & Kuteeva 2012; Pecorari et al. 2011; Jensen & Thøgersen 2011; Airey 2011; Bentley & Kyvik 2011; Ingvarsdóttir & Ambjörnsdóttir 2014). And few, if any, studies so far have, to my knowledge, systematically addressed scientists’ attitudes and practices regarding scientific terminology.

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<sup>4</sup> As may be unfamiliar to some readers, the Nordic countries have what might be translated into English as “Language Councils”. They are independent bodies typically under the Ministries of Culture in each country, and their mandate typically consists of advising individuals and institutions on linguistic appropriacy, monitoring and recording linguistic development and publishing linguistic reference works.

This, arguably, is a project worth undertaking as there has been a wealth of speculation in the Nordic countries that the national languages might cease to develop scientific terminology in the face of an ever increasing degree of Englishization to the detriment of students, scholars and the general public (see, e.g., contributors to Harder 2009). One commonly cited example in the early stages of the Danish debate, for instance, was that recently graduated vets or doctors would be unable to communicate with local farmers and patients if they had received their training exclusively in English. However, scientists themselves have rarely if ever been given a voice, so the present study is an attempt to shed light on the extent to which the concerns of those who have been engaged in the debate (i.e. the above-mentioned linguists, language council directors, politicians and members of the cultural elite and public) are corroborated by scientists themselves. This distinction between insiders and outsiders, or in Pikean terms, an emic versus an etic perspective, may turn out to be quite crucial as preliminary evidence seems to suggest that scientists themselves tend to prioritize communicative efficiency over the ethnolinguistic provenance of a specific scientific term (Hultgren 2014a). Thus, when faced with the choice between an English term and a literal Danish translation (e.g. *regular expression* vs *regulært udtryk*), Danish computer scientists reported choosing the one which would cause least communicative disruption. In an early paper, which helped set the agenda for research into the Englishized university, House (2003) made the rather obvious but important and often overlooked point that language can serve two purposes: communication and identification, and that in a context where English is used as a lingua franca, more importance might be accorded to its communicative than identity-related aspects. Thus, we might expect that for the above-mentioned debaters, the identification aspect of the national languages might carry more weight whereas for scientists themselves the communication aspect might prove more important.

One way to gain insight into the respective importance accorded to communication and identification is to compare the findings of the present study with previous studies which have compared lay people's attitudes to the influence of English across seven Nordic speech communities. In a large-scale and sophisticated pan-Nordic telephone survey of a representative sample of thousands of Nordic citizens, the researchers Kristiansen and Sandøy (2010) introduce what they refer to as the "mountain peak model" of Nordic purism (see Figure 1). It ranks seven Nordic speech communities from west to east according to how positive or negative their attitudes are to English influence. Attitudes were elicited in two ways: by asking participants about their preference for an English or a national language term, such as *email* vs *epost* or *life guard* vs *livvakt* for Swedish participants, with the national term adapted to each context, and by

1 asking about their attitudes to linguistic influence from English on their national  
2 language more generally. As shown in figure 1, the Nordic countries are ordered  
3 for purism from the most puristic (Iceland 1) to the least puristic (Denmark 7). As  
4 the researchers point out, this order corresponds exactly to how expert Nordic  
5 linguists would classify the official language policy of the respective Nordic  
6 countries as enacted by the national language councils (Kristiansen and Sandøy  
7 2010; Kristiansen 2010).<sup>5</sup> It is well known that the Icelandic language council  
8 is quite stringent, suggesting national language equivalents for words such as  
9 *telephone* (*sími*) and *computer* (*tölva*), where the chosen words in Danish would  
10 be *telefon* and *computer*. The researchers explain the mountain peak model by  
11 recourse to both linguistic and socio-historical factors. Linguistically, Swedish,  
12 Norwegian and Danish are more structurally similar to English than Icelandic,  
13 Faroese and Finnish; the latter is not even an Indo-European language. The  
14 latter three also distinguish themselves by a far more complex inflectional  
15 morphology, which may make the former three more receptive to lexical borrow-  
16 ing and other types of influence from English. Socio-historically, Sweden and  
17 Denmark have been the more powerful countries throughout history, dominating  
18 the others at various points, and this could be taken to suggest that they may be  
19 less hostile or sceptical to influence from the outside.

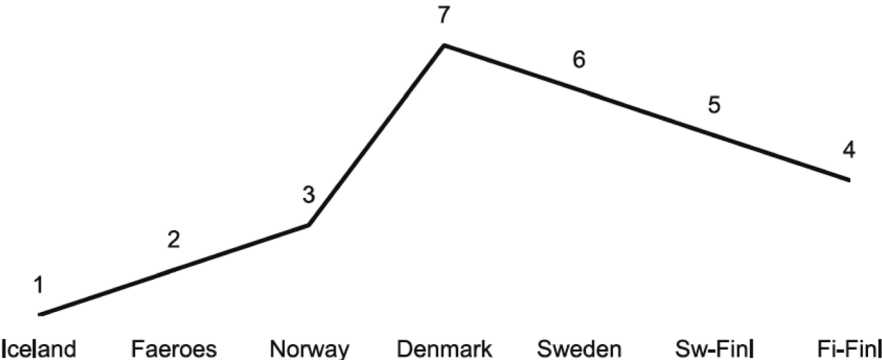


Figure 1: The “mountain peak model” of Nordic purism: Ranking of seven communities from “most purist” (1) to “most liberal” (7) (Kristiansen and Sandøy 2010: 3).

<sup>5</sup> Kristiansen (2010) also elicits covert attitudes to English through matched-guise techniques and interestingly finds that these form the exact opposite pattern to the overtly offered attitudes (with Icelanders the most positive and Danes the least). As the present study elicits only overtly expressed attitudes, we shall only be concerned with the overtly elicited ranking obtained by Kristiansen 2010 and Kristiansen and Sandøy 2010.

It will be interesting to find out if the mountain peak model is replicated when the focus moves from lay people to scientists. Whether or not this is the case might be explained by invoking House's (2003) distinction between language for communication and language for identification. Thus, if the mountain peak model is replicated among Nordic scientists it might be considered as evidence that the national languages serve purposes of cultural identification and affinity much in the same way as they do for lay people. If, on the other hand, the model is not replicated, one possible explanation might be that the language is regarded more pragmatically as a tool for communication, though other explanations cannot be ruled out either.

I begin by discussing the place of national language terminology in relation to domain loss, a well-established concept in Nordic language policy discourse. I then explain the methodology used before presenting and discussing the results. Finally, I consider some possible implications and limits to the study.

## 2 National language terminology and its relation to domain loss

In discussions about the increasing use of English in Nordic universities and its consequences, "domain loss" was until recently an established concept. The first part of the term "domain loss" ("domain") was originally used by the linguist Georg Schmidt-Rohr (1890–1945) in the 1930s (Haberland 2005). Perhaps because Schmidt-Rohr is now unfondly remembered for his scholarly contributions to the "race science" of the German Nazi era (Cameron 2007), the historical origin of the concept is rarely acknowledged, one notable exception being Fishman (Haberland 2005). Fishman used "domains" as an analytic concept to explain why speakers in multilingual settings choose one language over another, pointing to the role of "widespread socio-cultural norms and expectations" associated with "major clusters of interaction situations" (1970: 19) defined on the basis of participants, location and the topic of conversation. In the Nordic debate, however, "domain" has been understood not so much as an analytic concept to predict or model language choice but as a label applied *a priori* to an area of society which was perceived as being at risk of language shift. The "loss" part of the concept consequently refers to the national Nordic language being replaced by English in such "at risk" areas or domains, primarily academia and multinational corporations. "Domain loss" as a concept has attracted its fair share of criticism (Hultgren 2013; Preisler 2009; Haberland 2005), often on the grounds of being too imprecise and crude and of disregarding the fact that academia is far from a monolithic construct but is made up of

a range of activities, such as disseminating research to a variety of audiences, collaborating with colleagues within and outside the department, meetings and other administration activities, each of which is associated with their own patterns of language choice. As some scholars have begun to talk about the irrevocable demise of the “domain loss” concept (Haberland 2011), in its place has come “parallellingualism”, which is a Nordic-wide language policy initiative aimed at securing the status and use of the national Nordic languages alongside English, particularly in the academic domain (Nordic Council 2007).

Whether or not “domain loss” as a concept has outlasted its purpose, it has often been a moot point whether the absence of national Nordic terminology can and should be considered an aspect of domain loss. On the one hand, there has been talk in some Nordic contexts about creating terminological databases to secure the development of the national languages as fully-fledged and “complete” languages (Kristiansen 2012; Danish Language Council 2012), but on the other, some commentators have pointed out that languages are under constant evolution and that a presumed bottom-up lexical borrowing is a prerequisite for, not a threat to, their continued existence. Thus, as Laurén, Myking and Picht put it, “[i]t is a fact that no language covers all possible domains at all LSP [language for specific purposes] levels” (2002: 25), thereby implicitly acknowledging that no language is at any one time “lexically complete”. Nevertheless, one influential Danish commentator, the chairman of the Danish Language Council, has suggested that the lack of established Danish scientific terms may be a direct trigger of language shift as it becomes so cumbersome to communicate in Danish that speakers choose to speak English instead (Kirchmeier-Andersen 2008). Others, including the former chair of the Danish Language Council, may not see lexical borrowing as a direct trigger of language shift, but would argue that lexical borrowing and language shift are two sides of the same coin (Davidsen-Nielsen 2009; Davidsen-Nielsen 2005; see also Haberland et al. 1991), and that Danish language policy should consist of creating viable national-language alternatives to foreign terms. It is worth noting that this is in Denmark, the country which otherwise ranks as the least purist among the Nordic countries.

The need to maintain national language terminology is reiterated in a range of Nordic, national and institutional language policy documents (see, e.g., Danish Ministry of Culture 2008; Norwegian Department of Cultural and Ecclesiastical Affairs 2008; Nordic Council 2007; Hultgren 2014b). For instance, the *Declaration on a Nordic Language Policy* outlines four issues to work with: “language comprehension and language skills”, “the parallel use of languages”, “multilingualism” and “the Nordic countries as a linguistic pioneering region” (Nordic Council 2007: 93–95). The third issue, parallel use of languages, “refers to the concurrent use of several languages within one or more areas. None of the languages

abolishes or replaces the other; they are used in parallel” (Nordic Council 2007: 93). Six priority points are listed under the parallel use of languages:

- that it be possible to use both the languages of the Nordic countries essential to society and English as languages of science
- that the presentation of scientific results in the languages of the Nordic countries essential to society be rewarded
- that instruction in scientific technical language, especially in written form, be given in both English and the languages of the Nordic countries essential to society
- that universities, colleges, and other scientific institutions can develop long-range strategies for the choice of language, the parallel use of languages, language instruction, and translation grants within their fields
- that Nordic terminology bodies can continue to coordinate terminology in new fields
- that business and labour-market organizations be urged to develop strategies for the parallel use of language (Nordic Council 2007: 94)

It is particularly the second-to-last point relating to “Nordic terminology bodies” which is relevant here, though the fact that the wording is somewhat vague (e.g. the name of such “Nordic terminology bodies” is not mentioned) might reflect awareness that the national language councils have slightly different approaches to the issue. Nevertheless, the point does seem to suggest that national language scientific terminology is a concern and a priority in Nordic language policy discourse, despite what sometimes appears to be an overt denial, and notwithstanding some possible differences within the Nordic region (Salö 2014).

## 3 Methods

### 3.1 Procedures for data collection

To collect the data, a questionnaire was designed using *Survey Monkey* (an online survey tool) and emailed to scientists working at five universities in each of the capital cities of five Nordic countries: the universities of Iceland (in Reykjavik), Oslo, Copenhagen, Stockholm and Helsinki in March and April 2012. The inclusion in this study of universities in the capital cities only is not to deny the significance of other universities in this region; rather it is an attempt to delimit the focus of the study using objective criteria. In order to get a broader representation of science, three disciplines were included: chemistry (referred



1 **Table 1:** Number of respondents by country and discipline (Q = question(s)).

	Iceland			Norway			Denmark			Sweden			Finland			Total
	Ch	CS	Ph	Ch	CS	Ph	Ch	CS	Ph	Ch	CS	Ph	Ch	CS	Ph	
Q 1	6	7	6	14	21	25	27	20	19	19	25	29	16	28	29	
Q1 total	19 (response rate 42%)			60 (response rate 57%)			66 (response rate 46%)			73 (response rate 50%)			73 (response rate irretrievable)			291
Q2	3	4	3	8	17	16	17	12	15	12	16	23	12	24	18	
Q2 total	10 (response rate 22%)			41 (response rate 39%)			44 (response rate 31%)			51 (response rate 35%)			54 (response rate irretrievable)			200
Q3	5	5	4	11	21	21	19	15	19	19	21	24	14	24	23	
Q3 total	14 (response rate 31%)			53 (response rate 50%)			53 (response rate 37%)			64 (response rate 44%)			61 (response rate irretrievable)			245
Q4	5	6	6	11	21	22	19	19	19	17	23	26	15	26	25	
Q4 total	17 (response rate 38%)			54 (response rate 51%)			57 (response rate 40%)			66 (response rate 45%)			66 (response rate irretrievable)			260

18

19 to as “Ch” in Table 1), computer science (“CS”) and physics (“Ph”). A link to the

20 questionnaire was sent in an email. Respondents were identified and email ad-

21 dresses were obtained by looking at the departmental website for each of the

22 disciplines at each of the five universities. Only those individuals whose job title

23 was academic were selected. As the focus of the study is on national language

24 users, international scientists were excluded initially on the basis of their name.

25 But, because name is not always a valid indicator of the respondent’s first

26 language, an additional check was made by asking respondents to declare their

27 first language in the questionnaire. For the two bilingual (or bi-varietal) speech

28 communities, Norway and Finland, respondents were asked to specify if their

29 first language (variety) was Bokmål or Nynorsk (for users of Norwegian) or

30 Finnish or Finland Swedish (for users of Finnish). The two sub-categories of

31 Norwegian users have been collapsed, as the author judged that there was no

32 reason to suspect that the existence of local terminology would differ signifi-

33 cantly in the two varieties. Furthermore, users of Finland Swedish have been

34 excluded as they were too few. The questionnaire itself was written in English.

35 Respondents were enticed to participate with a 20 pound Amazon gift voucher.<sup>6</sup>

36

37 <sup>6</sup> The author gratefully acknowledges economic support from the Danish Research Council for

38 Culture and Communication) (grant number 09-070588) as well as the respondents who took

39 the time to complete the survey.

40

1 The aim was to obtain at least 15 respondents per discipline per country, but this  
2 proved impossible in the case of all three disciplines at the University of Iceland  
3 and also for chemists at the University of Oslo despite the questionnaire being  
4 emailed to the entire population in those categories. For all other categories,  
5 the questionnaire was sent to scientists in alphabetical order on a continuous  
6 basis until a satisfactory number of questionnaires had been completed. Table 1  
7 shows the number of scientists the questionnaire was emailed to per country  
8 and discipline and the number of respondents who provided an answer to each  
9 of the four questions which are reported on in this study. The questionnaire also  
10 asked a range of other questions, including how much English the scientists  
11 used in different areas of work, but only the four questions which relate to  
12 terminology are the focus here. The response rate for the four questions and five  
13 countries excluding Finland varied considerably and was between 22% and 57%.  
14 Between 200 and 290 Nordic scientists responded to each of the four questions.

15  
16 **3.2 Questions and their rationale**

17 As mentioned, this chapter focuses on four questions, each of which seeks to  
18 provide some empirical answers to the many speculations arising in public and  
19 scholarly debates about domain loss. The four questions, their response options  
20 and rationale are described in Table 2. The generic wording in square brackets  
21 was replaced by the name of the national language in each context, i.e. Icelandic,  
22 Norwegian, Danish, etc.

23  
24 **Table 2:** Questions, response options and rationale

Question 1	
27 Formulation	Do you find that the [national] language lacks established equivalents of English scientific terminology?
28 Response options	– Yes, often – Yes, sometimes – Yes, rarely – No – Not sure
33 Rationale	To obtain data on how widespread the presumed non-existence of national language scientific terminology is in the Nordic languages (or, more precisely, is reported to be by scientists). This has not been studied systematically before, but evidence from ethnographic studies as well as speculations in public debates and language policy initiatives suggest that national language scientific terminology may be missing.

Question 2

Formulation	Please give one or more examples of [national language] terminology lacking.
Response options	Free text
Rationale	To obtain a notion of what types of terms are typically missing in national language scientific vocabulary.

Question 3

Formulation	What do you do when this happens?
Response options (respondents may tick more than one option)	<ul style="list-style-type: none"><li>– Use the English term and continue the rest of the sentence in [the national language]</li><li>– Use the English term and continue the rest of the sentence in English</li><li>– Make up my own translation in [the national language]</li><li>– Explain what I mean using other words</li><li>– Comment explicitly on the lack of existing [national language] terminology</li><li>– Not sure</li><li>– Other (please specify).</li></ul>
Rationale	This question is asked to understand what scientists believe themselves to be doing when they are faced with wanting to express a term for which no national language alternative exists. The response options are drawn from two sources: 1) empirically documented strategies which non L1 users have been shown to draw on to express something they do not know how to say, notably paraphrasing, borrowing and meta-commentary (which may or may not be referred to as such in the literature) (Tarone 1978; Ljosland 2008; Hultgren 2013), and 2) from commentators on domain loss who have suggested that a lack of national language terms may prompt speakers to switch languages (Kirchmeier-Andersen 2008).

Question 4

Formulation	According to you, what are the consequences (if any) of using an English term in a stretch of speech in [your national language]?
Response options (respondents may tick more than one option)	<p>It impedes communication</p> <p>It facilitates communication</p> <ul style="list-style-type: none"><li>– It makes [the national language] less pleasing to the ear</li><li>– It makes [the national language] more pleasing to the ear</li><li>– It has no consequence</li><li>– Not sure</li></ul>

**Rationale** This question seeks to elicit scientists' attitudes to lexical borrowing,<sup>7</sup> which was assumed to be among the most commonly reported strategies deployed by scientists when faced with a missing term in the national language. This is with a view to find out the extent to which scientists share a commonly held impression that non-existing national language terminology constitutes a problem, and if so, what kind of problem. The binary response options (whether it impedes or facilitates communication and whether it makes the national language less or more pleasing to the ear) have been chosen to inform our understanding about the respective balance to be placed on language for identification and language for communication.

## 4 Survey results and some tentative explanations

### 4.1 Reported existence of national language scientific terminology

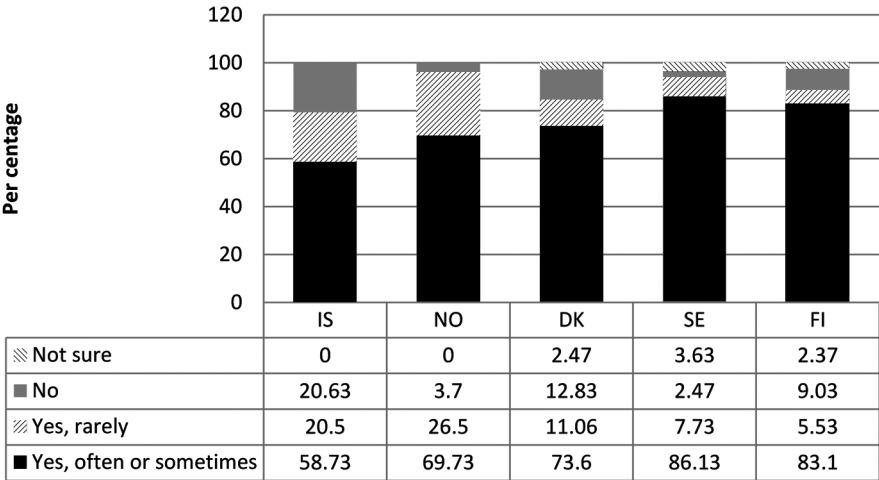
When asked for their impressions of whether the [national] language lacks established equivalents of English scientific terminology, the most noteworthy finding is that a substantial majority (between 58.73% and 86.13%) of respondents answer “Yes, often or sometimes” (see Figure 2). (The two response options “Yes, often” and “Yes, sometimes” have been collapsed here because no clear pattern emerged between them.) Between 5.53% and 26.5% answer “Yes, rarely” and between 3.7% and 20.63% say “No”. Around 2–4% of respondents declare that they are not sure. This could be taken as evidence that beliefs about the lack of national language terminology are not misguided; it certainly seems to be the case that Nordic scientists believe that they often lack national language terminology. This is not surprising, perhaps, when we take into account the most recent figures that 70–95% of academic output at Nordic universities is written in English; for doctoral dissertations, the range is 81–89% (Gregersen 2014; for a summary, see Hultgren, Gregersen and Thøgersen 2014).<sup>8</sup> If such a large proportion of research publication is in English, it is not surprising that national language terminology is felt to be missing to the extent that it is.

In terms of national differences, it appears that with 86.13% answering “Yes, often or sometimes”, Swedish scientists are the ones who most often find

<sup>7</sup> It is not always clear whether the practice engaged in should be referred to as “lexical borrowing” or “code-switching”. As “lexical borrowing” normally implies that the borrowed element fills a semantic void in the borrowing language (Onysko and Winter-Froemel 2011) it seems a more apt term than “code-switching”, which typically places greater emphasis on social than referential meaning (Meyers-Scotton 1988).

<sup>8</sup> The Nordic figures are given here with the caveat that cross-country comparisons are difficult because of differences in tertiary educational systems and methods of measurements.

1                   **Do you find that the [national] language**  
2                   **lacks established equivalents of English**  
3                   **scientific terminology?**  
4



20 **Figure 2:** Nordic scientists' questionnaire responses to the question "Do you find that the  
21 [national] language lacks established equivalents of English scientific terminology?" by  
22 country. (Percentages do not add up to 100 due to rounding).

23

24 national language terminology to be missing. They are followed, in descending  
25 order, by Finland (83.1%), Denmark (73.6%), Norway (69.7%) and finally Iceland  
26 (58.7%). There is no noteworthy pattern when it comes to disciplinary differences,  
27 so in Figure 2 these have been combined. Interestingly, the pattern follows that  
28 of lay people's attitudes towards English influence (see Table 3). Denmark  
29 appears to be the exception here, squeezing in between Norway and Finland  
30 for which there is no immediately obvious explanation.

31

32 **Table 3:** Lay people's attitudes towards English influence (Kristiansen and Sandøy; Kristiansen  
33 2010) compared to scientists' self-reported observations of missing national language  
34 terminology

35

Lay people's attitudes towards English (from most to least resistant)	Iceland	Norway	Finland	Sweden	Denmark
-----------------------------------------------------------------------	---------	--------	---------	--------	---------

36

Scientists who find that national language terminology is missing "often or sometimes" (from least to most common)	Iceland	Norway	Denmark	Finland	Sweden
--------------------------------------------------------------------------------------------------------------------	---------	--------	---------	---------	--------

37

38

39

40

The near match is especially noteworthy considering that the questions asked in the two studies differed. The scientists in the present study were asked “Do you find that the [national] language lacks established equivalents of English scientific terminology?” and the lay people in the Kristiansen and Sandøy (2010) and Kristiansen (2010) studies were asked about their attitudes to English influence, and answered on a scale from positive to negative. Thus, whereas one study asked about impressions of states of affairs, the other asked about attitudes. However, as noted above, Kristiansen and Sandøy observe that attitudes to English held by the general public correspond closely with the official policy of the national language councils: the more stringent the policy of the national language councils in adapting foreign terms morphologically and orthographically to national-language conventions, the more English-resistant the lay attitudes. So perhaps what we see here in the scientists’ reported lack of national language terms is (with the curious exception of Denmark) a reflection of the official language policy of the national language councils in each country.

## 4.2 Examples of national language terminology missing

Respondents were also asked to give one or more examples of scientific terminology missing in their national language. The overwhelming majority did not seem to have any problems coming up with such terms, many giving far more than the one example they were asked for as a minimum. Almost none declared that they could not think of any (see Table 4 for some examples chosen by the author). When looking closer at these examples, a few things are worth noting. Firstly, it is clear that these terms are highly specialized, low-frequency words. Secondly, as is common for neologisms, many of the terms are compounds (e.g. *dissociative electron attachment*, *solid state ionics* and *orthogonal synthon paradigm*), and this supports the observation that a high percentage of new terminology tends to take the form of compounds (Algeo 1980), many of which are created by combining existing words (as in all three examples above). Abbreviations are also a common form of neologisms, e.g. *FRET* (*Fluorescence Resonance Energy Transfer*), *PIE* (*Pulsed Interleaved Excitation*) and *RAFT* (*reversible addition fragmentation chain transfer*) (Raad 1989). Raad refers to this as a “regenerative trend”, and explains it thus “[a]t a time of tremendous expansion in scientific knowledge, terminology has come to rely on recycling the existing resources of the language by using available words to produce new ones in the form of acronyms, blends, analogies, metaphors and, most typically, compounds” (1989: 128). Thirdly, most of the terms, or constitutive morphemes, for which national language alternatives are reported missing have Graeco-Latin origins: for example,

**Table 4:** Examples of technical terms offered by scientists for which national language alternatives are reported to be missing

Country	Disciplines		
	Chemistry	Computer science	Physics
Iceland	dissociative electron attachment (micro)canonical ensemble chemical species breccia chromatography	list comprehension generator stack frame declarative programming language monad	resonator free spectral range evanescent wave spintronics
Norway	solute longitudinal relaxation solid state ionics pulsed laser deposition	bootstrapping jackknife pop-up window query builder cursor	plasma patch ion upflow qubit spline bystander effect
Denmark	quenching excited state device moiety FRET (Fluorescence Resonance Energy Transfer) PIE (Pulsed Interleaved Excitation)	multi-touch gestures motion tracking dispatcher shading assembler	rapidity spherical harmonics quasi-elastic squeezed states quarks
Sweden	nanophotonic brillouin zone end-capping ione-pair electrons screening	Gaussian beam Benchmark top-down expander graphs zero-knowledge proof	entanglement angular momentum closed-shell species isocurvature perturbations lapse function
Finland	cellulose whisker polymerization orthogonal synthon paradigm spin coater	kernel launch manifold learning service oriented computing run-length encoding straight-line grammar	steady satet swift heavy ion composite reaction entropy inlet

Finland (chemistry): *RAFT* (*reversible addition fragmentation chain transfer*)

*dissociative electron attachment*, *solid state ionics* and *orthogonal synthon paradigm* (Hultgren 2013; Ehlich 1989). These findings problematize the argument that English as a language of science hinders the development of national-language terminology. While on the one hand, scientists report that national language terminology is missing, on the other, a closer examination of this terminology suggests that they are created through well-documented processes of semantic extension using already existing or borrowed linguistic resources.

Another interesting point is that there is no disciplinary overlap between the different countries surveyed. One might have expected, for instance, that particularly for the closely related languages Norwegian, Danish and Swedish, researchers would highlight similar terms, but this does not seem to be the case. This might have to do with the fact that even within the same discipline, scientists tend to be so specialized that the terms used and needed in one field will not be the same as those used and needed in another.

4.3 Strategies reported when national language terminology is missing

When asked what they do when national terminology is missing, and when informed that they may tick more than one option, the most common response among Nordic scientists is that they use the English term and continue the rest of the sentence in their national language. Between 71.67% (Iceland) and 92.5% (Denmark) of Nordic scientists report engaging in such behaviour, which might be described as lexical borrowing. The least common response is to use the English term and continue the rest of the sentence in English, which we might refer to as code-switching. This latter behaviour is an assumption on which part of the Danish domain loss debate has rested, and which appears to be challenged by this self-reported data. Between these two extremes are some other options displayed in Figure 3. It is important to note here, however, that the respondents are answering this question based on a non-contextualised hypothetical situation. In other words, the answer might vary depending on whether they write

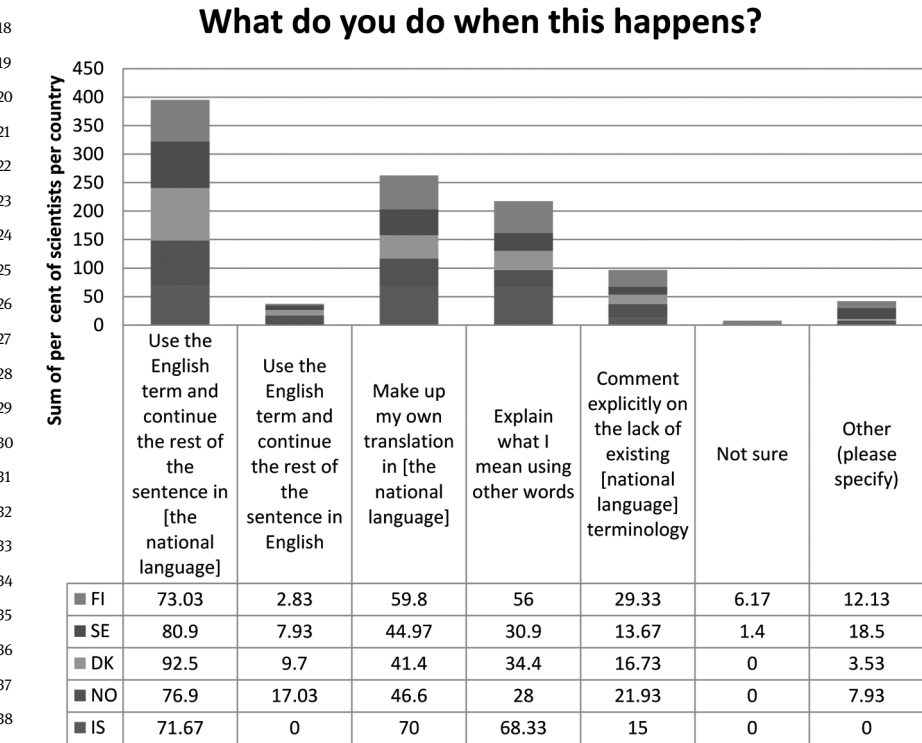
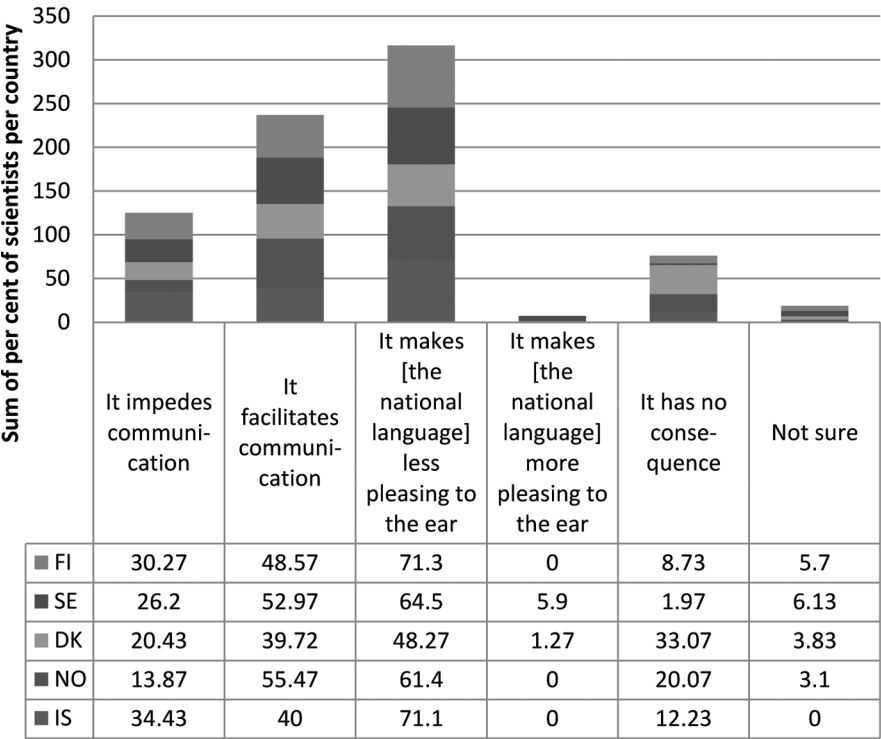


Figure 3: Strategies reported when national language terminology is missing



1                   **According to you, what are the**  
2                   **consequences (if any) of using an**  
3                   **English term in a stretch of speech in**  
4                   **[your national language]?**  
5  
6  
7



30 **Figure 4:** Nordic scientists' questionnaire responses (in per cent) to the question "According to  
31 you, what are the consequences (if any) of using an English term in a stretch of speech [in your  
32 national language]?"  
33

34 an article, give a lecture or engage in casual conversation with a colleague. Such  
35 decontextualization is a weakness of questionnaires, and will be returned to in  
36 the discussion. Given such methodological problems, it is useful to compare this  
37 data with that obtained from observations of actual behaviour, which seem to  
38 support it. For instance, in teaching, speakers sometimes draw on lexical resour-  
39 ces from different "languages" to get their point across (Ljosland 2008; Söder-  
40 lundh 2013).

**Table 5:** Lay people's attitudes towards English influence (Kristiansen and Sandøy 2010; Kristiansen 2010) compared to scientists' self-reported strategies when national language terminology is missing

Lay people's attitudes towards English (from most to least resistant)	Iceland	Norway	Finland	Sweden	Denmark
Use the English term and continue the rest of the sentence in [the national language] (from least to most common)	Iceland	Finland	Norway	Sweden	Denmark
Use the English term and continue the rest of the sentence in English (from least to most common)	Iceland	Finland	Sweden	Denmark	Norway
Make up my own translation in [the national language] (from highest to lowest)	Iceland	Finland	Norway	Sweden	Denmark

It is useful to compare the responses to the first three options above to those of the lay attitudes reported in Kristiansen (2010) and Kristiansen and Sandøy (2010). The national differences seem to correspond to some extent to the mountain peak model of Nordic purism (see Table 5). For example, the Icelandic scientists, as one might expect, report using strategies 1 and 2 above less frequently than their Nordic colleagues elsewhere (at 71.67% and 0%, respectively). However, the pattern is not an exact replication of the mountain peak model. Finland, for instance, squeezes into second place in front of Norway for all three response options (at 73.03%, 2.83% and 59.8%, respectively). While the first response option (switching back to the national language after using an English term) produces, with the exception of Finland, an exact replication of the mountain peak model (with Norwegian (76.9%), Swedish (80.0%) and Danish (92.5%) scientists following Icelandic and Finnish ones), the second response option (continuing the sentence in English after using an English term) sees the positions of Sweden and Denmark reversed (at 7.93% and 9.7% respectively, with Norway reporting the most frequent use of this strategy at a remarkable 17.03%). It is not clear what lies behind Norway's high reported usage of code-switching. While English proficiency may have something to do with it (Norway ranks second on Education First's English Proficiency Index (EF 2013)), this cannot be the only explanation as Sweden ranks first on this list and reports a lower use of code-switching. The third response option (making up their own translation in the national language) is again a near perfect replication of the mountain peak model (with Iceland at 70%, Finland at 59.8%, Norway at 46.6%, Sweden at 44.97% and Denmark at 41.4%), again with the exception of Finland and Norway in reversed positions.

The finding that Finland is somewhat more resistant to using English than Norway (see Figure 3 and Table 5) might have something to do with the fact that as a Finno-Ugric language, Finnish is less structurally similar to English and thus less receptive to loans from the language. This fact, of course, is also taken into account in the mountain peak model of Nordic purism which ranks the Nordic speech communities not only in relation to socio-historical factors but also to structural/linguistic factors. It might be, however, that structural/linguistic factors turn out to be more important in the context of scientific terminology than in the everyday vocabulary where, as shown above, the Latin and Greek genealogy is perhaps more transparent, but this would need to be explored in future research.

#### 4.4 Attitudes to lexical borrowing

The fourth and final question assesses scientists' attitudes to the consequences (if any) of using an English term in a stretch of speech in their national language. Respondents were permitted to tick more than one option. A majority in each country (71.3–48.27%) reported that it would make the national language less pleasing to the ear. However, between 39.2% (Denmark) and 55.47% (Norway) of respondents also thought that it facilitated communication, the second highest response option. It is possible, in other words, for respondents to think at one and the same time that lexical borrowing facilitates communication but also makes the national language less pleasing. This is probably because these relate to different properties of the language; one is an aesthetic judgement, the other a judgement about efficiency. The third most frequent response category is that lexical borrowing impedes communication. The explanation for this apparent contradiction is not clear, but one interpretation might be that whether lexical borrowing facilitates or impedes communication is context-dependent and could have to do with type of word borrowed and the disposition of the interlocutor to comprehend, but these are answers which the questionnaire cannot provide. Between 1.97% (Sweden) and 33.07% (Denmark) of respondents report that lexical borrowing has no consequence, the fourth most common response option, and a tiny minority, between 0 (Iceland, Finland and Norway) and 5.9% (Sweden) declare, perhaps unsurprisingly, that it makes the national language more pleasing to the ear.

In terms of national differences, there is *some* evidence of lay people's attitudes to English being reproduced among scientists but also some rather spectacular exceptions to this. Thus, Icelandic scientists feature most often in a first or second place, but also third place. Finland, similarly, features two first

places, two second places and one third place. The odd ones out here seem to be the Scandinavian scientists whose response pattern is rather variable. For instance, on the options available, the Norwegian scientists rank variably from 1st to 5th place, the Swedes rank from 1st to 5th places and the Danish scientists are placed in 1st, 4th and 5th places. In other words, the two language communities whose language is least structurally similar to English (Iceland and Finland) form a more predictable pattern than the other three.

**Table 6:** Lay people’s attitudes towards English influence (Kristiansen and Sandøy 2010; Kristiansen 2010) compared to scientists’ attitudes

Lay people’s attitudes towards English (from most to least resistant)	Iceland	Norway	Finland	Sweden	Denmark
It impedes communication (from highest to lowest)	Iceland	Finland	Sweden	Denmark	Norway
It facilitates communication (from lowest to highest)	Denmark	Iceland	Finland	Sweden	Norway
It makes the national language less pleasing to the ear (from highest to lowest)	Finland	Iceland	Sweden	Norway	Denmark
It makes the national languages more pleasing to the ear (from lowest to highest)		Iceland Finland Norway		Denmark	Sweden
It has no consequence (from lowest to highest)	Sweden	Finland	Iceland	Norway	Denmark

## 5 Concluding discussion

This study set out to elicit attitudes to national language scientific terminology among scientists working at universities in five Nordic nation states and also how they respond to terminology issues. The motivation for the study was two-fold. Firstly, it sought to complement a hitherto primarily etic account offered by commentators and language policy makers in the Nordic countries, with an emic account offered by the scientists themselves. Secondly, it sought to examine whether previously documented national differences in lay people’s attitudes to English influence was replicated among scientists. Let us consider the most important findings relating to these two aims and discuss their implications.

Firstly, with 58.7–86.1% of Nordic scientists answering “Yes, often or sometimes” to the question, the lack of national language terminology alleged in policy debates seems to be supported by evidence obtained from the scientists

1 themselves. This evidence, of course, is based on perceptions rather than reality  
 2 itself, an issue we shall discuss further below. The extent to which this is a cause  
 3 for concern, however, depends largely on whether one perceives lexical borrow-  
 4 ing as a problem. Recall from Figure 3 that at 71.67–92.5%, lexical borrowing is  
 5 the strategy most commonly reported when Nordic scientists are faced with a  
 6 missing term in their national language. In addition, a closer look at what type  
 7 of terms scientists are missing suggests that they are often created by combining  
 8 already existing words or morphemes, often of Latin and Greek derivation, such  
 9 as *dissociative electron attachment*, *solid state ionics* and *orthogonal synthon*  
 10 *paradigm*. Such terms are coined to convey the many new meanings that the  
 11 rapid advances in science necessitate. While, perhaps surprisingly, a majority  
 12 of respondents in each country (71.3–48.27%) reported that it would make the  
 13 national language less pleasing to the ear if the language user engaged in  
 14 lexical borrowing, the second most frequent response option (39.2–55.47%) was  
 15 that it simultaneously facilitated communication. Thus, lexical borrowing seems  
 16 to be perceived as facilitating rather than hindering communication despite  
 17 some aesthetic disadvantages.

18 One possible implication of these findings for language policy initiatives  
 19 in the Nordic communities might be not to automatically assume that national  
 20 language terminology is best developed through top-down corpus planning  
 21 initiatives such as the creation of terminological databases. As suggested by  
 22 the findings of this study and ethnographic observation, bottom-up, speaker-  
 23 initiated, lexical borrowing is common (Ljosland 2008; Hultgren 2013; Söder-  
 24 lundh 2013). Thus, it might be argued that commentators and policy makers  
 25 need to convince us why top-down terminological databases would be a better  
 26 option than bottom-up lexical borrowing.

27 The second aim of the study was to explore if previously documented  
 28 national differences in lay people's attitudes to English influence (Kristiansen  
 29 2010; Kristiansen and Sandøy 2010) were replicated among scientists. The pic-  
 30 ture that emerges here is not clear cut, though, as we might have expected, there  
 31 is a tendency for Icelandic, Finnish and, to some extent, Norwegian scientists  
 32 to rank above Swedish and Danish ones on response options which suggest a  
 33 greater resistance towards English. The pattern which ranks the Nordic speech  
 34 communities according to their respective resistance towards English (in the order  
 35 from most to least resistant: Iceland, Norway, Finland, Sweden and Denmark)  
 36 thus seems to be partly corroborated, but there are, as noted, also some excep-  
 37 tions for which there is currently no clear explanation.

38 With regard to the second aim of the study, the introductory section hypoth-  
 39 esised that if the ranking pattern of Nordic lay people's attitudes to English was  
 40 not replicated by Nordic scientists it might be taken as evidence in support of

House's (2003) claim that culture and power are less relevant in a context where English is used as a lingua franca than pragmatic and utilitarian considerations. Yet, as already noted, there is evidence both in favour and against the mountain peak model of Nordic purism being replicated when the focus moves from lay people to scientists. This might be because the difference between the two functions of language distinguished by House, identification and communication, may, in reality, be impossible to separate (Canagarajah 2006). In fact, this seems to be supported by the respondents' reply to the question of what the consequences are of using an English term in a stretch of speech in the national language. To this, the two most common responses are that it makes the national language less pleasing to the ear but also that it facilitates communication. Thus, Nordic scientists seem at one and the same time to adopt a view of language as being both for communicative and symbolic-aesthetic purposes.

Last but not least, it is important that the many limitations of questionnaires are acknowledged. Unlike ethnography, questionnaires only report what individuals claim to be happening. Nor do they allow for a more in-depth understanding offered by interviews of how respondents interpret the questions (Ferguson, Pérez-Llantada and Plo 2011). For instance, the response "It has no consequence" listed as an option to the question about what the consequences are of using an English term in a stretch of speech in the national language is one which is particularly open to interpretation and would benefit from further exploration. Similarly, when asked what strategies respondents use when they need a term with no national-language equivalent, the answer might well depend on what mode and context the respondent has in mind. Although it is to a certain extent possible to clarify such ambiguities in the questionnaire design, there will always be scope for interpretation. It is possible that the less than clear cut pattern which emerges in relation to the national differences is attributable to random variation in how questions are interpreted. Statistical measures might be used in future studies to get closer to this answer. Given these and other known limitations of questionnaires as a methodology, it is no wonder that they have been described as a "quick and dirty" way of collecting data (Fischbacher et al. 2000). However, as long as the results are not over-interpreted and are supplemented with other methodologies, they may serve a function in providing breadth over depth. Thus, while a disadvantage with questionnaires is clearly the way in which it drives respondents to choose from a fixed set of responses, this is also a strength in that it makes findings more comparable.

Future studies might beneficially draw on a combination of observations of actual behaviour and interviews to gain a more addressee-sensitive understanding of if, how and why national equivalents of scientific terms are created. For

instance, it might be that among scientists themselves, the preference is for borrowing an established term from “English” (and I use this word advisedly to reflect the Graeco-Latin origins of many of these terms). In contrast, when communicating their findings to a general audience, scientists may well choose to engage in paraphrasing to render the meaning of the “English” term in the national language. In other words, it cannot be assumed *a priori* that there is an actual need to create an exact national-language equivalent of a scientific term for communication to be successful. If this indeed turns out to be the case, then it might be at odds with the priority set in the *Declaration of a Nordic Language Policy* to “coordinate terminology in new fields” (Nordic Council 2007: 94) in a top-down manner. Of course, this might still be considered important for ideological and symbolic reasons, but the extent to which it would be compatible with the needs of the language user might be an interesting question for future research to explore.

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